

REMARKS

Upon entry of this Amendment, claims 1-20 will be pending in this application. Claims 9-12 are withdrawn from consideration. Reconsideration and allowance in view of the foregoing amendments and following remarks are respectfully requested.

Entry of this amendment is proper under 37 C.F.R. § 1.116 as the amendments:

(a) place the application in condition for allowance for the reasons discussed herein; (b) do not raise any new issues that would require further consideration and/or search as the amendments merely amplify issues discussed throughout the prosecution; (c) do not present any additional claims without canceling a corresponding number of claims; and (d) place the application in better form for appeal, should an appeal be necessary. The amendments are necessary and were not earlier presented as they are in response to arguments raised in the final rejection. Entry of the Amendment is respectfully requested.

Applicants are pleased to note the Examiner indicated that claims 13-20 are allowed and that claims 4-8 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph and to include all the limitations of the base claim and any intervening claims.

Claim Rejections – 35 U.S.C. § 112

Claims 1-8 have been rejected under 35 U.S.C. § 112, second paragraph. Claim 1 now recites, *inter-alia*, “wherein said lattice-like shower head is formed of a metal pipe comprising a plurality of gas discharge holes configured and arranged such that a normal to each of said holes is oblique to the surface of the substrate and each of said holes is formed on a curved surface of said metal pipe.” The Examiner questions how can a lattice-like shower “plate” be formed of a metal pipe, how are the gas discharge holes positioned and whether the lattice-like shower plate is made of multiple pipes.

Applicants have amended claim 1 to recite “a lattice-like shower head” by replacing the phrase “shower plate” with the phrase “shower head.” Applicants have done so merely to advance the prosecution of this application and to further clarify the language of the claim although one of ordinary skill in the art would also understand the phrase “shower plate.”

Applicants submit that a lattice-like shower plate or head can be formed of a metal pipe. One embodiment of a lattice-like shower plate or head can be, for example, a metal pipe that is made of a metal pipe that zigzags back and forth to form a lattice-like shower

plate or head. The lattice-like shower plate or head is not necessarily made of multiple pipes. In one embodiment, the lattice-like shower plate or head is made of a plurality of metal pipes (such as the embodiment shown in Figure 2), however in another embodiment the lattice-like shower plate or head can also be made of a single metal pipe as stated above. Other lattice-like shower plate or head configurations are also within the scope of the present invention.

With regard to the Examiner's question as to how the discharge holes are positioned. Applicants have amended claim 1 to recite "a normal to each of said holes is oblique to the surface of the substrate and each of said holes is formed on a curved surface of said metal pipe." Thus, Applicants submit that one of ordinary skill in the art would understand how the holes in the lattice-like shower head are positioned. Amendment to claim 1 are merely intended to further clarify the claim language and not for limitation.

Therefore, Applicants respectfully submit that all pending claims are in full compliance with § 112 and respectfully request that the rejection under § 112, second paragraph, be withdrawn.

Claim Rejections – 35 U.S.C. § 103

Claim 1-3 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Otani *et al.* (Japanese Patent Publication 06-260434) in view of Hama *et al.* (US Pat. No. 5,525,159), Oyama (Japanese Patent Publication 02-237020), and Omi *et al.* (Japanese Patent Publication 11-302824). Applicants respectfully traverse this rejection for at least the following reasons.

The Examiner, in response to the arguments filed August 20, 2002, contends that the arguments are moot in view of the new ground of rejection. The Examiner applied the newly discovered reference Oyama (Japanese Patent Publication 02-237020) and contends that Oyama teaches a showerhead 14 which has process gas holes 15 inclined towards a wafer 13 and the holes are inclined towards the center of the wafer 13 to obtain a uniform film and thus it would have been obvious to one of ordinary skill in the art to provide the lattice-like plate of Otani *et al.* in view of Hama *et al.* with gas holes of Oyama.

Applicants reiterate the arguments filed August 20, 2002. Specifically, claim 1 recites, *inter-alia*, "a lattice-like shower head provided between the dielectric material shower plate and the substrate to be processed so as to discharge a gas, which has a composition different from that of the gas discharged from the dielectric material shower plate, to a side of

the substrate to be processed; and at least a part of the gas discharged from the dielectric material shower plate flows to the side of the substrate to be processed by being passed through an opening part of the lattice-like shower head, wherein said lattice-like shower head is formed of a metal pipe comprising a plurality of gas discharge holes configured and arranged such that a normal to each of said holes is oblique to the surface of the substrate and each of said holes is formed on a curved surface of said metal pipe.”

In the invention recited in claim 1, the normal to each of the holes is oblique to the surface of the substrate and each of the holes is formed on a curved surface of the metal pipe allowing the process gas to be obliquely incident on the substrate so as to improve substrate in plane uniformity of a process. Indeed, when the process gas is incident obliquely the process gas is made to evenly spread over the entire surface of the substrate, thus the process uniformity is greatly improved.

In contrast, the bipolar electrode 30 in Otani *et al.* has holes 34 such that the gas would exit vertically to electrode holder 18 (see, drawing 2 of Otani *et al.*). Similarly, in Hama *et al.*, the head 172 has pipe lattice 176 having supply holes 174 oriented downward as shown in Figures 12 and 14 of Hama *et al.* Therefore, in Hama *et al.* the gas exists through the holes vertically (i.e., normal) to substrate S.

In Oyama, a plurality of gas blowing holes 15 are formed on a shower plate 14 (see Figures 1-8 in Oyama). The holes 15 are formed in such a manner that the more they are located closer to the circumference, the more the holes are inclined towards a wafer 13. The gas which blows out from the holes 15 is thus concentrated on the wafer 13. Consequently, Oyama *et al.* does not provide a lattice-like shower head having an opening part wherein at least a part of the gas discharged from a dielectric material shower plate flows through to the side of the substrate. The holes in the shower plate in Oyama are simply provided on a shower plate which only corresponds to the dielectric material shower plate of the present invention. Therefore, if one were to combine the teachings of Oyama, i.e. providing holes to a shower plate, with the device of Otani *et al.* in view of Hama *et al.*, the holes would be provided to the shower plate (jetting out ports 10 in Figure 1 of Otani *et al.*) or (shower head 122 in Figure 1 of Hama *et al.*) and not to a metal pipe lattice-like shower head.

Moreover, the holes in the showerhead 14 of Oyama are arranged such that they are inclined at the periphery of the showerhead. The holes are, however, normal to the wafer at least at the center of Oyama's showerhead (see Figures 1 and 3 in Oyama). Consequently, at

least at the center of Oyama's showerhead, the flux of process gas is vertically incident on the surface of the wafer. Therefore, Oyama does not disclose, teach or suggest "said lattice-like shower head is formed of a metal pipe comprising a plurality of gas discharge holes configured and arranged such that a normal to each of said holes is oblique to the surface of the substrate and each of said holes is formed on a curved surface of said metal pipe."

With regard to Omi *et al.*, this reference merely discusses a method for forming passivated film of aluminum oxide to provide a fluid feed system for a highly corrosive fluid.

Consequently, neither of Otani *et al.*, Hama *et al.*, Oyama or Omi *et al.* disclose, teach or suggest alone or in combination the subject matter recited in claim 1. Therefore Applicants respectfully submit that claim 1, and claims 2-3 which depend from claim 1, are patentable and respectfully request that the rejection of claims 1-3 under § 103(a) be withdrawn.

#### CONCLUSION

In view of the foregoing, the claims are now believed to be in form for allowance, and such action is hereby solicited. If any point remains in issue which the Examiner feels may be best resolved through a personal or telephone interview, he is kindly requested to contact the undersigned at the telephone number listed below.

Attached is a marked-up version of the changes made to the claims by the current amendment. The attached Appendix is captioned "**Version with marking to show changes made**".

All objections and rejections having been addressed, it is respectfully submitted that the present application is in a condition for allowance and a Notice to that effect is earnestly solicited.

Respectfully submitted,

Pillsbury Winthrop LLP

By: \_\_\_\_\_

Glenn J. Perry

Reg. No.: 28,458

Tel. No.: (703) 905-2161

Fax No.: (703) 905-2500

GJP/KXG  
1600 Tysons Boulevard  
McLean, VA 22102  
(703) 905-2000

APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claim 1 has been amended as follows:

1. (Twice Amended) A plasma processing apparatus for applying a process to a substrate to be processed, the plasma processing apparatus comprising:

a chamber of which interior can be depressurized,

a gas supply system constructed and arranged to supply a gas to the chamber and an exhaust system configured and arranged to exhaust the gas supplied to the chamber and to depressurize the chamber;

a part of a wall constituting the chamber being a flat plate dielectric material plate formed of a material which passes a microwave therethrough substantially without a loss;

a flat plate dielectric material shower plate, which is formed of a material which passes a microwave therethrough substantially without a loss, being provided between the dielectric material plate and plasma excited in the chamber;

a plurality of gas discharge holes being formed in the dielectric material shower plate so that at least a part of the gas supplied by the gas supply system is discharged through the plurality of gas discharge holes through a gap between the dielectric material plate and the dielectric material shower plate;

a flat plate slot antenna being provided on an outer side of the chamber with the dielectric material plate interposed therebetween so as to supply a microwave for exciting plasma through the dielectric material plate;

an electrode being provided on an inner side of the chamber so as to hold the substrate to be processed;

a lattice-like shower [plate] head provided between the dielectric material shower plate and the substrate to be processed so as to discharge a gas, which has a composition different from that of the gas discharged from the dielectric material shower plate, to a side of the substrate to be processed; and

at least a part of the gas discharged from the dielectric material shower plate flows to the side of the substrate to be processed by being passed through an opening part of the lattice-like shower [plate] head,

wherein said lattice-like shower [plate] head is formed of a metal pipe comprising a plurality of gas discharge holes configured and arranged such that a normal to each of said holes is oblique to [process gas is obliquely incident on] the surface of the substrate and each of said holes is formed on a curved surface of said metal pipe.

End of Appendix